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(54) Granulated material, and production method of same, for preparation of foundry molding sands.

(57) The invention refers to a granulated material for preparation of foundry molding sand, to be added to them to improve their composition, reduce pollution and handling problems, which consists of a refractory framework in the form of granules the size of which ranges from 0.1 to 0.4 mm and an external coating on said refractory framework which in turn consists of a fit material for providing lustrous carbon. The refractory framework is formed by a zircon sand, chamotte, chromite, olivine, sillimenite, mullite or mixtures thereof, with a free silice content not greater than 3 %. The invention also relates to a hot-process and a cold-process for production of said granulated material.

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Granulated material, and production method of same, for preparation of foundry molding sands.

The present invention relates to a granulated material comprising a refractory framework coated with a material fit for providing "lustrous carbon" and suitable for the composition of foundry molding sands.

The invention also relates to a method for the production of said granulated material as well as to the compositions of the molding sands containing such material.

Molding sand actually used in foundry practice for the production of molds for cast-iron castings consists of sand and clay as binder. Bentonite is especially used with advantage as binding clay.

In the composition of molding sands a coal dust is usually added with the main purpose of preventing formation of defects on the surface of castings. Said defects, as it is known, are prevalently due to the thermal expansion of the sand and to metal-mold material reactions such as the formation of ferrous oxide on the surface of castings which, by reaction with silic , produces low-melting point silicates responsible for

surface roughness in the castings. The coal dust absorbs the thermal expansion of the sand, since during the casting, when the surface temperature of the mold rises to about 1000°C, it is caused to distill releasing volatile matter and increasing the void around the expanding sand grains. Furthermore said volatile matter generates an inert atmosphere and produces "lustrous carbon" which coats the sand grains with a refractory film, not wettable by molten metal, thus avoiding the metal from reacting with the mold material.

"Lustrous carbon" is defined as an allotropic, optically isotropic state of the carbon having a microcrystalline, essentially bidimensional structure, intermediate between amorphous carbon and graphite. Lustrous carbon is obtained on wide specific surfaces by pirolysis of heavy hydrocarbons which are released by carbon-based materials during contact with the molten metal. Properties, characteristics and methods of analysis concerning lustrous carbon are extensively described by V.I. Bindermagel, A. Kolors, K. Orthus: Schnellverfahren zur Bestimmung der aus Formstoffzusatzen (method of analysis for mold materials additives), Giesserei, Vol. 51, 12 Nov., page 729-730 (1964).

Moreover, the addition of coal dust improves green and dry strength of the sand and reduces gas permeability.

Coal dusts which have been extensively used in the past are natural substances such as milled low-grade anthracite or pearl-pitch, characterized by a low content of ash and noxious products such as sulphur, with a lustrous carbon yield not greater than 12% of its own weight and normally lower than 10%. More recently advanced techniques for the preparation of coal dusts have introduced the use of synthetic substances yielding

more than 70% of lustrous carbon, thus considerably reducing (up to 7 times) the amount of coal dust used.

Therefore recent practice in the preparation of molding sands (which contain 80-85% by weight of a refractory material, clay substance as binders and the above mentioned carbon-based materials) is to use both synthetic substances with a high yield of lustrous carbon and natural substances such as low-grade anthracite powders or mixtures thereof.

In any case the molding sands, after their use for molding, are continuously regenerated to produce new molds and are added with refractory material, clay binder and carbon-based additives at each cycle.

The most common refractory material used for the preparation of molding sands is silica sand because of its low cost; other types of sand, such as olivine, chamotte, chromite, zircon, sillimanite, mullite and the like can be used for particular purposes. Nevertheless it is well known that with respect to other kinds of sands, a serious drawback of silica sand consists in that it has a higher thermal expansion coefficient, which moreover increases suddenly at about 500°C in correspondence to the quartz allotropic transformation from the alpha to beta state.

According therefore to actual foundry practice for regenerating additions, silica sand is generally used, as well as compositions based on bentonite or binding clays as binders, low-grade anthracite powders or synthetic materials or mixtures thereof as carbon-based additives.

Dilatometric properties of molding sand, according to this way of working, remain nearly unchanged or tend to

get worse progressively with regenerating cycles. Furthermore the actual practice is to add the additives as powders to the molding sand, especially the carbon-based ones and particularly the synthetic ones with a high lustrous carbon yield. This fact produces a serious pollution problem, a suspension of fine dust being present in the working environment, besides a further problem concerning the metering of the various additives to the exhausted sand. In this connection the addition of synthetic material with a high lustrous carbon yield was suggested by the Applicant to be carried out in form of a pre-mixed matter together with the clay binder, thereby partly reducing handling and working problems.

It is the object of the invention to improve the composition of green molding sands by adding to them, during regeneration, a refractory material, characterized by a lower thermal expansion coefficient than the one of the initially used sand, which is, in other words, able to positively and progressively modify its dilatometric properties.

Another object of the invention is to produce quartz- and dust-free material to be used for the preparation of molding sands, thereby reducing both pollution of the working environment and material handling problems.

According to the invention, a granulated material for the preparation of molding sands is provided, the size of the granules being in the range of 0.1÷0.4 mm, i.e. a dust-free material, comprising a refractory framework externally coated with a synthetic coal dust material fit for providing lustrous carbon in a similar amount to the one produced by a natural coal dust. In particular, the refractory framework will be made with a material having a null or very low thermal expansion

coefficient, such as zircon, chamotte, chromite, olivine, sillimanite or mullite sands and preferably consisting of a silicate with a content of free crystalline silica not greater than 3%.

In this way the addition of only one component to the foundry molding sands has the double effect of adding a coal dust and of regenerating the sand with a refractory material. Thus avoiding the handling of powder-producing materials and contemporaneously adding a refractory material, during regenerative additions, which progressively improves the dilatometric properties of the refractory framework as a whole.

The refractory framework material, according to the invention, is precoated with a substance fit for producing a considerable amount of lustrous carbon upon melting. As lustrous carbon producing material, organic polymers with softening temperature range of 70-180°C are generally used, such as plastics or resins of the type of polyethylene, polypropylene, coumaronic resins, polystyrene, glycerophtalic resins, petrolic resins, glysonite and pitchy substances, phenolic resins and more generally any other material fit for producing, upon melting, lustrous carbon according to foundry methods in an amount ranging between 15 and 90% of its own weight.

A method for producing the granulated material according to the invention comprises melting the organic material and mixing it in a hot process with the granules of refractory material.

Another method is based on the fact that said organic material is solvent-soluble and therefore can be directly added to the granules of refractory material when mixed

in a drum with a solvent, in order to produce a proper resin coating on the granules by evaporating the solvent, which is recovered in a subsequent step. A person skilled in the art is well aware of how selection of the solvent, on the basis of the type of organic material used, is to be carried out. A particularly preferred solvent is white spirit.

The material produced according to said methods is homogeneous, granular and dust-free, each granule being coated with a layer of carbon-based material yielding a high percentage of lustrous carbon. Such homogeneous granulated material is directly used for regenerating molding sands, in place of the two separate components of refractory framework and coal dust.

A practical, particularly preferred application of this invention provides for the use of olivine sand, chromite sand or the like or their mixtures either with a granule size ranging between 0.1 and 0.4 mm or as a powder. The sand, or sand mixture, is heated to 150°C and then mixed with coumaronic resin; the percentage of the resin is 10% calculated on the weight of the refractory framework. After a few minutes of mixing, during which liquefied resin produces a coating on the refractory granules, the mixture is cooled and sieved to break any possible lump, thus obtaining a dust-free granulated material.

Practical examples concerning the production of the granulated material according to the invention will be given hereinafter.

Example 1

900 kg of chromite sand with a particle size of 0.1-0.3 mm and a Cr_2O_3 content of 44.5% are fed to a mixing drum

and heated to 160°C, then 100 kg of polystyrene in the form of granules or powder are added whith the following characteristics:

specific weight	1.05
purity	99%
Vicat test	195-200°F
yield value	10 g per 10 min

After 3-4 minutes of mixing, the mixture is cooled and discharged onto a vibrating screen to obtain a granulated material with a granule size ranging between 0.1 and 0.3 mm, each granule being coated with polystyrene.

Said cromite sand precoated with polystyrene yields 7-8% of its own weight in lustrous carbon, the same amount being provided by a coal dust obtained from the grinding of a low-grade anthracite. Such a synthetic material can be added to a molding sand according to normal practice in the art for the addition of coal dust.

Example 2

950 kg of olivine sand with granule size ranging between 0.06 and 0.4 mm,and the following chemical analysis:

MgO	42-44%
SiO_2	42-43%
$FeO+Fe_2O_3$	8-9.5%
$Al_2O_3+TiO_2$	1.2-2.2%
CaO	1.5%
Calcination losses	0.5-1.5%

are fed to a mixing drum with 100 kg of a solution containing 50% of white spirit and 50% of petrolic resin, with the following characteristics:

softening point	105-110°C
iodine index	79
saponification index	0
acid value	0
solubility in white spirit	full range

after a few minutes of mixing, the solvent is sucked from the mixing drum to completely coat the sand granules with the resin. Any possible dot is broken on a vibrating screen thus obtaining a dust-free material yielding a percentage of lustrous carbon corresponding to 3-3.5% of its own weight.

Said material is added to a molding sand in such an amount so as to have a constant lustrous carbon yield equal to 0.2-0.6%. In this way the molding sand is also enriched with a non-expandable refractory material, thus minimizing surface defects on castings due to thermal expansion problems.

According to the practice of the invention, the amount of resin-based coating on the refractory material will be of 0.5 to 60% by weight and in particular more preferably 1.0 to 30.% by weight. For example, a refractory material with 25% of coating consisting of a synthetic substitute of a mineral coal dust, would be able to release upon melting lustrous carbon in the percentage of 15÷16% by weight.

In addition to the above mentioned advantages concerning dust-free handling of the material and the progressive improvement of the dilatometric properties of the initial molding sand, the granulated material according to the invention further offers the advantage of improving the extracting properties of castings and obtaining better surfaces on same.

Claims

1. A granulated material for the preparation of foundry molding sand, characterized in that it comprises a refractory framework in the form of granules, whose size ranges from 0.1 to 0.4 mm, and an external coating on said refractory framework, consisting of a material fit for providing lustrous carbon in an amount ranging from 15 to 90% of its own weight, the amount of coating of said material on said refractory framework being 0.5 to 60% of the total weight of the granulated material.

2. The granulated material according to claim 1, in which said refractory framework consists of a material selected between zircon sand, chamotte, chromite, olivine, sillimenite,mullite, or mixtures thereof, with a free silica content not greater than 3%.

3. The granulated material according to claims 1 or 2, in which said material fit for providing lustrous carbon is a material selected among plastics or resins as polyethylene, polypropylene, coumaronic resins, polystyrene, glycerophtalic resins, petrolic resins, glysonite and pitchy substances, phtalic anidride, phenolic resins and their mixtures, the amount of lustrous carbon supplied by said material during the melting process being from 15 to 90% of its own weight.

4. A method for the production of a granulated material as claimed in any of the preceding claims from 1 to 3, including the steps of: heating in a mixing drum at a temperature of 70-180°C a refractory material in the form of granules with a size range of 0.1 to 0.4 mm; feeding the mixing drum with a material fit for providing lustrous carbon in an amount of 15 to 90% of its own weight, thus producing a mixture therein; mixing the mixture so that the material fit for providing lustrous carbon coats the refractory granules; cooling the mixture, and sieving it in order to break any possible lump.

5. The method for the production of a granulated material as claimed in any of the previous claims from 1 to 3, consisting of: feeding a mixing drum with a refractory material in the form of granules with a size range of 0.1 to 0.4 mm; feeding said mixing drum with a material fit for providing lustrous carbon in an amount of 15 to 90% of its own weight, said material being dissolved in a solvent; mixing the mixture; evaporating said solvent so as to cause the material fit for providing lustrous carbon to coat the refractory granules; and sieving said granulated material in order to break any possible lump.

6. A foundry molding sand including a granulated material as claimed in any of the claims from 1 to 3, in such an amount that the lustrous carbon yield of said molding sand is 0.2 to 9.6% of the total weight of said molding sand.

European Patent Office

EUROPEAN SEARCH REPORT

Application number
EP 81 83 0010.5

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	DE - A1 - 2 638 042 (G. FISCHER AG) * claim 6 *	3
	DE - B2 - 1 920 224 (VEREIN ZUR FÖRDERUNG DER GIESSEREI-INDUSTRIE) * claims 1, 2; examples 1 to 8 * & GB - A - 1 300 273	3
	DE - A - 1 952 357 (RAVENSBERGER HÜTTE) * claims 1 to 6 *	3
A	DE - A1 - 2 716 168 (AB NYNÄS-PETROLEUM et al.) * claim 16 *	3
A	DE - A1 - 2 313 649 (BUDERUS'SCHE EISENWERKE) * claim 1 *	3
A	DE - B - 1 458 104 (VEREIN ZUR FÖRDERUNG DER GIESSEREI-INDUSTRIE) * claims 2, 4 *	3
A	DE - A - 2 317 218 (G. HEINZE) * claims 1, 2 *	2

CLASSIFICATION OF THE APPLICATION (Int. Cl.³)

B 22 C 1/00
B 22 C 1/02
B 22 C 1/04

TECHNICAL FIELDS SEARCHED (Int. Cl.³)

B 22 C 1/00

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Berlin	08-04-1981	GOLDSCHMIDT

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